

COMMUNICATIONS CONSOLE

AND

VOTING COMPARATOR

REPLACEMENT RFP

FOR

MANISTEE COUNTY, MI

PREPARED BY:

RF Systems Engineering Associates, Inc.

8794 Q Ave Mattawan, MI. 49071

Tele: (269) 372-3260

Manistee County 911 Console and Voter Replacement RFP

Table of Contents

SECTION 1 GENERAL INFORMATION.....	2
SECTION 2 BACKGROUND INFORMATION.....	7
SECTION 3 PROJECT SPECIFICATIONS	11
Scope of Work.....	11
SECTION 4 CONSOLE SPECIFICATION	12
General Specifications.....	12
Equipment Requirements.....	12
Factory Testing.....	12
Manuals.....	12
SYSTEM CHARACTERISTICS.....	13
Console Operator Position	14
General Console Operator Position Features.....	23
CENTRAL ELECTRONICS PACKAGE.....	29
General.....	29
Modules and Operation.....	29
SECTION 5 Audio Signal Comparator Specification	34
GENERAL INFORMATION.....	34
TECHNICAL REQUIREMENTS.....	34
SECTION 6 UNINTERRUPTABLE POWER SUPPLIES.....	42
SECTION 7 GROUNDING GENERAL PRACTICES.....	43

SECTION 1 GENERAL INFORMATION

Statement of Purpose

It is the intent of this specification to provide Manistee County 911 with an up-to-date IP based radio communications dispatch console and receiver voting comparators to replace their existing dispatch console, and the receiver voting comparators for two VHF channels.

Manistee County will not invest in old technology that will soon be made obsolete by advances in wireless communications. Manistee County requests that the potential vendors comply with the terms of the request for proposal, but if there are alternative methods of providing the service contemplated in the request for proposal they should be provided in addition to the primary solution as an alternative proposal. Nothing in this request for proposal is expected to inhibit the creativity in a viable business solution offered by the potential vendor.

These specifications do not include any proprietary item, circuits or devices which would preclude any communications equipment manufacturer from providing a proposal. All technical tolerances and rating specifications are considered the current state of the art electronics, and are currently being met by commercially available equipment. The fact that a manufacturer does not produce equipment to meet these specifications, providing the criteria are met, will not be considered sufficient cause to judge the specifications restrictive.

All equipment requiring FCC type approval, acceptance or certification shall have approval at time of contract of the equipment. All electronic equipment shall be solid state utilizing silicon semiconductor technology (except as otherwise specified) and shall reflect the latest advances in the state of the art.

All equipment proposed must be new, of current design and manufacture, free of defects, dents, scratches and corrosion. Equipment design and construction shall be consistent with good engineering practice, and shall be executed in a neat and workman like manner.

All equipment shall meet or exceed the applicable standards of the Electronic Industries Association, the Federal Communications Commission, and shall conform to the specifications of the local telephone company with respect to audio levels, frequencies and control voltages to be impressed upon telephone lines.

Additional Information

Questions regarding the RFP shall be delivered in writing no later than December 30, 2013. Any additional information or interpretation of the RFP document shall be supplied by the consultant. All requests shall be delivered to RF Systems Engineering Associates, Inc. 8794 W Q Ave, Mattawan, MI 49071. Questions may be attached to an email and sent to mwhately@rfsystems.org.

Any addendum or addenda issued may include changes, corrections, additions, interpretations or information, and issued ten business days or more before the scheduled closing time for filing bids will be binding upon the Proposer. Copies of such addenda will be supplied to all persons who have obtained copies of the original RFP, failure to receive or obtain such addenda will not excuse the bidder from compliance

Proposal Due

Sealed proposals will be received at the Manistee County 911 Center, 1527 E Parkdale Ave, Manistee, MI 49660. Proposals are due February 14, 2014 by 10:30 AM.

Late bids received after the date and time listed above will be return unopened to the bidder.

Two originals and two copies of the Proposal will be submitted. The bid response costs shall be in a separate sealed envelope. The financial envelope will be opened on the bid opening date. If a proposal

Manistee County 911 Console and Voter Replacement RFP

is deemed non compliant or does not meet technical evaluations, the copies of the proposal may be returned to the vendor.

Withdrawal of Proposal

A proposal may be withdrawn on written request of the proposer prior to the scheduled closing time for filing proposals. Negligence on the part of the Proposer in preparing his proposal confers no right to withdraw his proposal after the scheduled closing time for filing.

Preparation Cost

This Request for Proposal does not commit the Manistee County 911 to pay any cost incurred by any proposer in submission of a proposal, or making any necessary studies or designs for the preparation of a proposal, or for the procuring or contracting for the items to be furnished under the Request for Proposal.

Technical Data and Drawings

A detailed equipment list, specifications and technical data sheets with pictures for all items bid must be included in the proposal. Any item that is proposed must have a complete model number, brochure, and technical specification sheet included or be subject to not being acceptable. The literature will provide sufficient information necessary to provide proper evaluation.

Any drawings that are supplied must be of such quality as to preclude fading to the extent of illegibility if exposed to normal illumination for extended periods of time.

Certificates and Insurance

A standard corporate or partnership certificate must be included in the proposal document.

The contractor will maintain the following insurance during the execution of and until the contract is completed. The insurance will be public liability and property damage insurance to protect the Contractor and Manistee County, MI. from any and all claims for damage or personal injury including death, which may arise from the execution of the contract, including all operations of Sub-contractors. Coverage will be for not less than the following:

Personal injury: \$500,000.00 / claimant; \$1,000,000.00 / occurrence

Employer's Liability: \$100,000.00

Equipment Responsibility

The successful proposer will be responsible for the full value of materials and equipment furnished by the supplier until formal acceptance by the purchaser after the Acceptance Test Plan.

Proposer Understanding

By submitting a proposal, the proposer certifies that the specification has been read and that all of the requirements the specification are fully understood.

All rights, title and ownership in and to all material and data prepared under the provisions of these specifications shall belong to the County, including the right of republication.

The vendor warrants that in performing the services it will strictly comply with the descriptions and representations as to the services described in these specifications. The Vendor also warrants that the products will be uniform in appearance, clean and presentable in accordance with generally applicable standards and will not be in violation of any laws.

Vendors are prohibited from assigning, transferring, conveying, or otherwise disposing of these services without the previous consent in writing of the County.

The County will have the right at any time to terminate the work required of the Vendor by written notice of such termination provided to the Vendor by the County and in the event of such termination,

Manistee County 911 Console and Voter Replacement RFP

the Vendor will be entitled to compensation for all work authorized and performed.

The County and the Vendor acknowledge and agree that any and all information concerning the others business is confidential and proprietary. The duplication, use or disclosure of any confidential or proprietary information to any person will not be permitted without the written authorization by the other party. All equipment and software to be used by the County in the implementation of the radio communications system should be considered confidential and proprietary. Neither party will use the name, trademark, or trade name of the other party in publicity releases or advertising or in any other manner including customer lists without prior written approval of the other.

The County, any employee of the County, or any agent of the County shall be held harmless against any liability to third parties arising from the negligence of the Vendor or its agents and the license to or use by the County of the software including the violation of any third party's trade secret, proprietary information, trademark copyright or patent right in connection with the services provided.

The Vendor shall function as an independent contractor and will not be considered an agent or employee of the County for any purpose, and the employees of the Vendor will not in manner be held out as agents or employees of the County.

The fees and charges specified are the total fees and charges for the services and will not be increased except as agreed in writing. If the Vendor is of the opinion that any work that has been directed to be performed is beyond the scope of these specifications, the Vendor will promptly notify the County of the fact. The County will be the sole judge as to whether or not such work is in fact beyond the scope of this specifications and whether or not it constitutes extra work. If so the County will provide compensation to the Vendor on a negotiated basis. All extra work will be authorized in writing only.

The Manistee County 911 reserves the right to accept or reject portions of a Vendor's proposal and purchase a sub-system that can be logically separated from another.

User List

Proposers must supply a list of current users of similar Dispatch Consoles and receiver voting comparators with the addresses, names of contact persons, and telephone numbers.

Rejection Rights

Manistee County 911 reserves the right to reject any and/or all bids in whole or in part, and to waive irregularities not effecting substantial rights. A proposer may be disqualified for any of (but not limited to the following reasons):

- Failure to use the Proposal Form Furnished
- Lack of signature by an authorized representative on the Proposal Form
- Unauthorized alteration of the Proposal Form.
- Any evidence of agreement or collusion among bidders or prospective bidders acting to illegally restrain freedom of competition by agreement to quote a fixed price, or otherwise, will render the proposals of such Proposers void.

Alternate Proposals

Deviations from the specifications which may result in lower cost and/or improved performance will be accepted. Proposers must describe, in writing, equipment which is in full agreement with the specification as well as suggest as a suggested alternate, in sufficient detail, to permit evaluation. Proposers will explain, in writing, why the alternate configuration will provide equivalent or improved performance and/or lower cost.

Alternate Proposals must be in a separate sealed package and so marked. The alternate must be submitted under the same guide lines as the primary proposal.

Manistee County 911 Console and Voter Replacement RFP

Proposers must submit proposals for all items listed on the proposal form including items marked as optional.

Proposers are encouraged to prepare their Proposals without exception. Exceptions must be on a separate sheet entitled EXCEPTIONS if it is necessary to do so. Bidder must understand that Manistee County 911 may not accept the exception and that some exceptions may require that the bid be rejected as non-responsive. Vendors response shall be structured with a paragraph by paragraph listing of Compliance, or Exception.

Performance Bond

Within 20 calendar days after the successful vendor is notified, a performance and payment bond shall be delivered to Manistee County 911. This bond will be in the amount equal to 100% of the proposed price and will maintain force until final acceptance is signed by Manistee County 911. The successful contractor shall pay all premiums and cost of this bond. Attorney-in-fact who signs the bond must file with the bond a certified and effectively dated copy of their power of attorney.

Price Validity

All offers shall keep the prices quote to Manistee County 911 in response to this RFP in effect and valid for one (1) calendar year from the date of bid opening.

The following payment schedule is proposed by the County and is subject to negotiations with the successful Vendor.

- 50% - upon installation of equipment.
- 30% - upon commencing live operation and completion of acceptance test plan.
- 20% - 30 days after the representatives of the Vendor and Manistee County 911 determines that there are no more additional modifications required.

Warranty and Maintenance

All equipment supplied by the vendor shall have a warranty which shall include all parts, sub assemblies, complete assemblies, travel, and labor for repair. All vendors shall include in their proposal the standard terms of Warranty for the specified equipment and labor. Any deviation from the standard Warranty to provide a one year Warranty shall be clearly stated in the Warranty proposal.

All equipment will be put on a three year maintenance agreement after the warranty period expires. Manistee County 911 shall retain the right to review the service providers performance, and maintenance cost versus time and material cost on an annual basis. In the event of service dissatisfaction, Manistee County 911 shall have the right to address these issues with the service agent, and reserve the right to terminate the maintenance contract with a 30 day written notice. The price of the maintenance is to be included with the proposal. The terms of the agreement will include a five (5) percent increase per year.

Pre – Bid Meeting

A pre- bid meeting to provide clarifications, and allow vendors a site walk will be held on Tuesday January 7, 2014, at 10:00AM . The location of the meeting is the Manistee County Emergency Operation Center, 1525 E Parkdale Ave, Manistee, MI.

Manistee County 911 Console and Voter Replacement RFP

Evaluation Criteria

The RFP will be evaluated first on technical merit and compliance. After it is determined that a vendor meets the minimum scoring, the financial cost envelope of the bid response will be opened. The evaluation will take into account the following:

- Proposal Quality.
- Vendors understanding of the project.
- Specification compliance.
- Experience with similar systems.
- Location of Service and installation facilities.
- Training

The cost evaluation will take into account the following:

- Initial cost
- Total project cost over the four year period.
- Future pricing
- Ability to hold pricing for 1 year.

SECTION 2 BACKGROUND INFORMATION

Current System Environment

Manistee County 911 radio communications system is predominately VHF high band conventional radio system. The local law enforcement departments in Manistee County utilize the Michigan Public Safety Communication Systems (MPSCS) to communicate with each other and the Michigan State Police.

Manistee's existing radio communications console is a Zetron 4000 series button and light emitting diode type. Replacement parts are becoming more difficult to obtain. The existing console has 10 radio interface modules. The console also has an expansion module for single button paging of approximately 45 different tone sets.

<u>Site</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Ground Elevation (mtrs)</u>	<u>License Ant. Height (mtrs)</u>	<u>Licensed ERP</u>
Kaleva Tower	44° 22' 01.0"N	085° 55' 22.3"W	303.0	51.0	250 Watts
Filer Tower	44° 13' 13.0"N	086° 18' 53.0"W	198.0	52.0	135 Watts
Nine Mile Tower	44° 22' 20.0"N	086° 10' 10.3"W	268.0	60.0	165 Watts
Wellston Site	44° 13' 57.2" N	085° 57' 43.3" W	262.1	53.3	RX Only
State of Michigan	44° 19' 9.9"N	086° 12' 34.8"W	281.6	Microwave relay site	

Fire 1

Fire 1 is a VHF high band conventional repeater channel. There is a transceiver located at the Nile Mile site, and the Filer site. This channel also has voting receivers at the Filer, Kaleva, and Wellston sites. The comparator is located in the 911 center. The existing voting comparator is manufactured by General Electric Corporation. Replacement part for these units are also difficult to obtain, and adding new capabilities is not possible.

The repeater at the Nine Mile site is a Kenwood TKR-750. The repeater at Filer is a Kenwood NXR-710. The voting receivers at each of the sites are Kenwood NXR-710. MDC1200 signaling is being used on this channel.

Fire 2

Fire 2 is a VHF high band conventional repeater channel. There is a transceiver located at the Nile Mile site, and the Filer site. This channel also has voting receivers at the Filer, and Kaleva, site. The comparator is located in the 911 center. The existing voting comparator is manufactured by General Electric Corporation. Replacement part for these units are also difficult to obtain, and adding new capabilities is not possible.

The repeater at the Nine Mile site is a Kenwood NXR-710. The repeater at Filer is a Kenwood NXR-710. The voting receivers at this sites are Kenwood NXR-710. MDC1200 signaling is being used on this channel.

Fire 3

Fire 3 is a VHF high band conventional repeater channel. There is a transceiver located at the Kaleva site. This channel does not have a comparator.

The repeater at Kaleva is a Kenwood NXR-710.

Manistee County 911 Console and Voter Replacement RFP

MPSCS 1, 2, and 3

There are four control stations located at Manistee 911 for communicating with the local Law Enforcement agencies including the Manistee County Sheriff's department. Two of the control stations are Motorola ASTRO consolettes, one is a Kenwood <model number> and a Motorola <model number>. The Motorola <model number> is currently configured in the console to patch the MPSCS system with other departments not on the MPSCS.

Manistee County desires to have the unit ID number from the MPSCS radios passed to the new console, and have the console cross reference the ID number to a name, and have the name display at each operator position.

If replacement of a control stations is necessary, the provided unit must meet specifications to operate on the MPSCS radio system. Vendors are to include the control station pricing as separate line items in their response.

Fire 1 and Fire 2 Backup Control

There are two control stations located at Manistee County 911. These control stations are for use in the event of a microwave failure. The system is configured for automatically switch over when the microwave fails.

Local Control VHF

There is a VHF control station located at Manistee County 911 for communicating with other agency, such as the Road Commission and the United States Forest Service, on an infrequent bases. The console provides the Push-to-Talk, transmit and receive audio. The channel selection is manually selected by the operator.

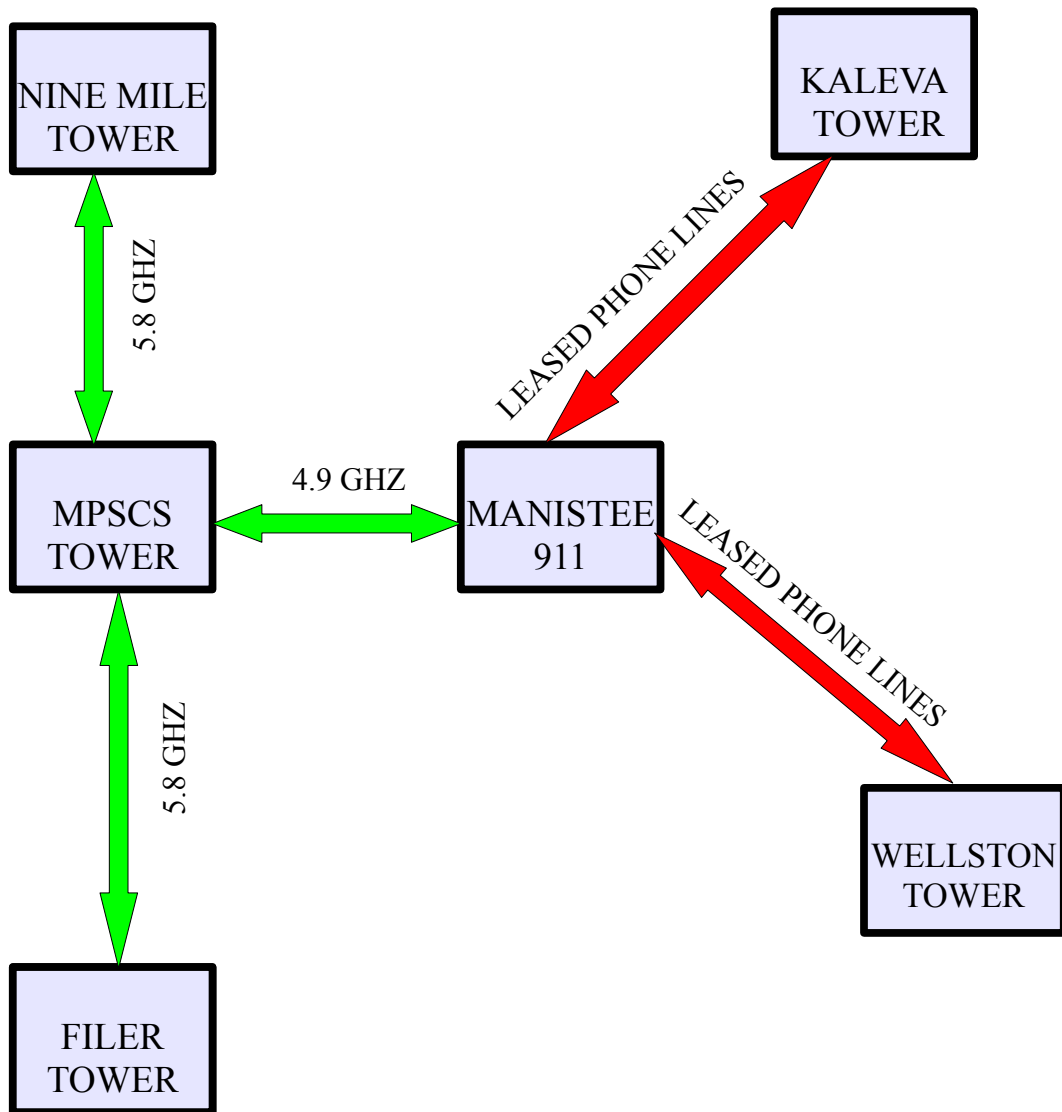
Site Inter-connectivity

The site connectivity for Manistee County 911 is a mixture of unlicensed microwave and leased telephone lines.

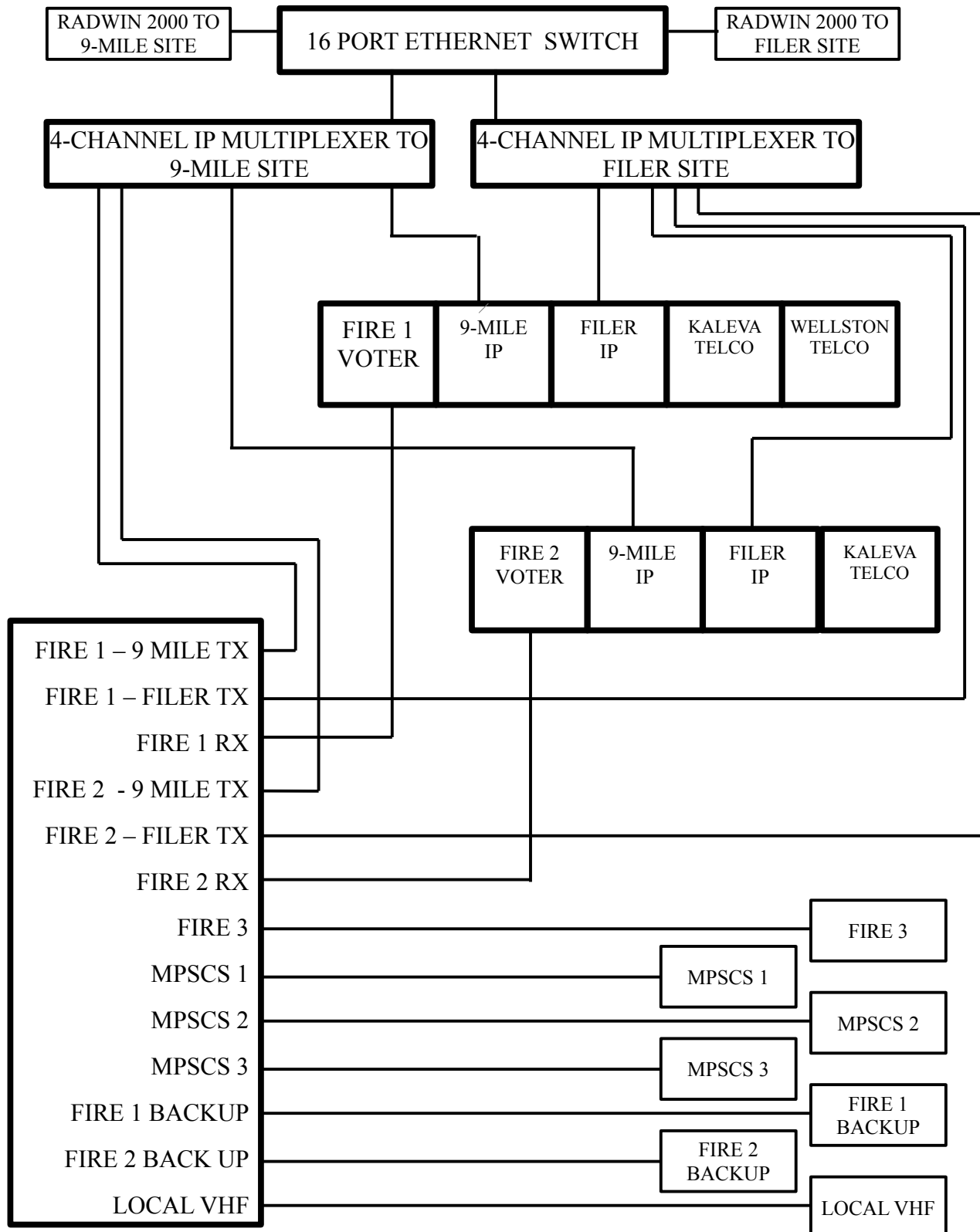
The Kaleva and Wellston Sites are connected to Manistee County 911 via leased telephone lines.

The Nine Mile and Filer sites are connected to Manistee Count 911 via unlicensed microwave. Their is a path from Manistee 911 to the MPSCS tower , Northeast of Manistee. This site is a relay site to the Nine Mile and Filer sites. (See Block Diagram on next page)

Current System Block Diagram



Current Dispatch Block Diagram



SECTION 3 PROJECT SPECIFICATIONS

Scope of Work

Manistee County 911 desires to replace their existing Zetron 4000 series button and light emitting diode type radio communications console with an up-to-date IP-Based console. Manistee County 911 desires three operator positions. The current system includes single-button paging functions that must be included in the new console.

Detailed specifications for the console is in Section 4 of this document.

Manistee County 911 desires to replace their existing General Electric receiver voting comparators. There are currently two VHF analog channels, Fire 1 and Fire 2 with voting comparators. Manistee County 911 desires to have automatic transmitter steering with the capability of the dispatcher to override the automatic transmitter steering in order to send fire paging tones to the appropriate transmitter site. The new console and voter must work together to provide steering the single button paging tones to the proper transmitter site.

Manistee County desires to locate the new voting comparators at the Nine Mile site. Remote control and monitoring is required, and must allow the dispatchers the ability to:

- Manually force a site to be voted.
- Enable / disable a site from being voted
- Select site or sites for console audio transmission

The dispatcher must also be able to monitor the following:

- Module status (disabled, voted, or selected)
- Receiver unscelched
- When TX audio is being steered through a module
- If the module, or site is experiencing a fault condition

Detailed Specifications for the voting comparators is in Section 5 of this document.

The new console screens are to be installed in place of the current Zetron consoles without interruption of service.

The successful vendor is responsible to provide all required accessories and cables for a professional, clean installation. All cables are to be properly labeled. Labels shall be permanent, professional in appearance, and provide high contrast with the background to which they are affixed. Hand written labels will not be accepted Individual circuits on TELECO blocks shall be labeled in a neat fashion using indelible ink.

The console is to be grounded as per the manufacture's specifications. General practices for grounding are listed in Section 7.

SECTION 4 CONSOLE SPECIFICATION

General Specifications

The Communications Control Console shall provide all the necessary functions to operate FM two-way radio base or repeater stations. The Communications Control Center Consoles shall consist of flat screen monitor technology. All three of the operator positions shall be located at the Manistee County 911 center. The system need to have the capability to easily add operator positions and channel capabilities.

Equipment Requirements

The Communications Control Console equipment proposed shall meet or exceed EIA and FCC requirements which are current at the time of the system proposal. The equipment shall also meet all domestic US. telephone company specifications regarding audio levels and DC control line voltages.

Factory Testing

The console shall undergo extensive factory testing prior to shipment. This testing shall encompass all phases of the console equipment from the board level to the console level. Automatic computerized board testing shall be used to check components and functions on each circuit board before it is assembled into a console. Once assembled, the console shall be functionally tested utilizing automatic computerized system testing.

Manuals

The following manuals shall be provided to facilitate initial installation, operator training, and long term maintenance.

Service Manual

A description of each module, including a theory of operation, board overlays, and circuit diagrams shall be provided. Explanations of diagnostic display interpretations shall also be included.

Operator's Manual

One operator's manual shall be furnished with each operator position. This manual shall provide a basic operational description of the equipment and other pertinent operational details. The manual shall be short, simple, and shall include pictures showing the various operator controls. This item is to be provided in addition to the service manual.

Installation Manual And Documentation

The installation manual shall consist of a printed section that describes the proper console installation procedures. It shall also include those details that are unique to the system, such as the digital address of each module and the termination point of each audio pair and auxiliary input/output function presented to the central electronics package.

SYSTEM CHARACTERISTICS

Ergonomic Design

The console system shall be designed to enhance the dispatchers' capabilities in performing resource management tasks and to minimize the effort and concentration required for efficient radio control. This shall be accomplished through the use of a single, high resolution color LCD display with control module graphics representing each base station/repeater channel and auxiliary function group at each console. Consoles using individual channel control modules and/or consoles that use monochrome displays shall be not acceptable under this specification.

To minimize operator confusion and the chance of errors being made, all channel and individual IDs shall be referred to by actual names NOT numeric references. Cross referencing a channel name to a number shall not be required for any dispatch operation.

Each function on each channel shall have its own switch graphic and color coded indicator. Only single keystroke operations shall be allowed to implement all primary dispatch functions. Controls and/or indicators with common row or column labels and/or control schemes that require more than one keystroke to implement a routinely used function shall be not acceptable under this specification.

Modular Construction

To enhance the overall flexibility and allow for ease of future expansion, the system shall be of totally modular design and construction. This requirement applies to the cabinets, electronics and system software.

System Architecture

The system architecture shall consist of two main components: a common Central Electronics Package for the system and a number of Operator Consoles which share this Electronics Package. The design shall be based on the distributed microprocessor concept.

Console Position/Central Processor Interface

Each console in the system shall be individually connected to the central processor. The connection shall provide a data link and three audio links (SELECTED AUDIO, UNSELECTED AUDIO and MICROPHONE AUDIO). The manufacturer must specify the maximum distance any console may be located from the Central Processor package using a direct wire line link. In the event the console requires remote interface, the manufacture must specify the number of interfaces required at the time of bid. The successful vendor shall be required to supply any remote interfaces, and programming after the bid, if a console position requires the interface, and has not been moved farther than the manufactures specification from the central processor.

Remote Console Interface

If separations in excess of the manufactures specifications are required between the console and Central Processor package, a remote interface adapter shall be provided. The remote adapter shall provide full console control at the remote location including full parallel cross indication with all other consoles, selective intercom, all console audio, supervisory control and system diagnostics.

Equipment Interchangeability

For ease of service and reduction of spare modules, all similar boards shall be completely interchangeable with minor adjustments. These minor adjustments shall consist of personality firmware/configuration files, switch setting(s), and/or jumper changes.

Power Line Surge Protection

AC line transient and surge protection shall be provided for the Central Processor and each operator position in the system. The nominal discharge current rating for each line surge protector shall be 10,000 amperes or more.

TELECO Surge Protection

Transient and surge protection shall be provided for each Radio Control line interfaced to the telephone company in the system. The surge protectors shall be sealed, three element, gas filled spark gaps, having a nominal discharge current rating of 5,000 amperes or more.

Console Operator Position

General

Each of the three (3) operator console position shall include the following basic components as a minimum:

- An audio interface unit with Selected and Unselected audio speakers.
- Dual Foot switch
- A Personal Computer based on current Intel or AMD microprocessor technology or equivalent.
- A 23" or larger LED back lit LCD Monitor using IPS Technology.
- Dual condenser gooseneck microphone.
- Dual headset jacks.
- Back lit illuminated keyboard for low light level conditions.
- Wireless mouse with Bluetrack technology.
- Built-In Instant Recall recording for all channels with Channel / Alias ID Tagging

The audio interface unit shall be capable of being mounted in an EIAS 19" frame and there shall be no need for the dispatcher to see or access the audio interface unit to operate the console.

Input Devices

Mouse or Trackball

The operator shall execute functions and operations by positioning a screen pointer (cursor) on the screen and pressing one of two buttons located on the mouse or trackball.

Footswitch

A footswitch shall be provided to permit the console operator to key the selected resource or to disable the coded squelch within the base station without the use of hands.

Gooseneck Microphone

A high quality cardioid pattern gooseneck microphone having a uniform frequency response and a minimum front-to-back discrimination of 15 dB shall be provided on an 18-inch flexible arm. The microphone shall incorporate a hum resistant design and shall be usable near CRT displays. The microphone amplifier shall include a speech filter that is tuned to the guardtone frequency. The microphone base shall include PTT and Monitor buttons.

Headset Jack

One or two headset jack(s) shall be provided which allows the operator to hear select audio via a headset and to allow the operator to respond via a microphone attached to the headset. This jack shall be compatible with either 4 or 6 wire headsets. Inserting the headset plug into the headset jack shall automatically disconnect the console microphone and select speaker and disable the acoustic feedback cross-muting features. The microphone amplifier shall include a speech filter that is tuned to the guardtone frequency. The base station transmitters shall be controlled via the GUI based Transmit switches, footswitch, or by the transmit switch that is part of the headset.

The (Each) headset jackbox shall be equipped with a cable which connects the jackbox to the console. The length of this cable shall allow the jackbox to be mounted in a logical location at the time of installation. The cable shall be long enough to provide the proper cable dressing upon installation.

The capability to converse on the telephone using the same operator headset that is used for radio conversations shall be provided. Connection to the jack-equipped (telephone) (Call Director) shall be provided. Registered couplers shall be provided if required.

The telephone audio shall be provided on a separate instant recall recorder output.

Software Programs

Console Configuration Program

All console system data shall be managed from a single point via a console configuration program. This database shall store and control all resource data. Resource data shall include all radio resources, telephone resources, auxiliary input and output resources as well as operator aliases.

The console configuration program shall allow an authorized personnel to create and edit: resources, resource options, and auxiliary control names; resources and functions available at an operator position.

Alias Database Management Program

A software database program shall provide on-line aliasing of radio unit IDs, status numbers and message numbers. The program shall allow for an optional server to be used.

Any alias changes to radio unit IDs, status numbers, message numbers shall cause the console system to be modified once. Once modifications have been made to the database, each operator position shall be updated via an automatic single point download from the database server.

The system will include the ability to make modifications to each operator position individually and transfer the alias database to all operators by copying the database files. The alias database program shall be able to run from any operator position using an authorized password.

Customized Screen Configurations

The installer, supervisor, or authorized personnel shall be able to configure the operator position capabilities and screen display to suit different operator positions, different applications, or personal preferences. These configurations shall be able to be done at all operator position. No additional equipment, nor any modification of PROM information, shall be required to perform the functions described. Any number of these screen configurations shall be stored on the position. The following is the minimum list of features that can be customized in each configuration.

- Create new configurations
- Modify existing configurations
- Determine the number of folders on the screen
- Determine the number of Patch/Msel folders on the screen
- Determine which of the different items (e.g. Toolbar, Activity Log, etc.) are included in the configuration.
- Determine how the information displayed in the Activity and Paging history logs
- Assign/Remove radio, telephone, and auxiliary input/output resources to various folders and determine location.
- Determine where features will be placed on the resources
- Determine how the resource shall be displayed (expanded or condensed)
- Determine how the resource shall be scaled in each area
- Determine color scheme to be used
- Set initial volume level of radio and phone resources
- Set ringing tone on phone resources
- Name the Folders used for dispatch operations
- Determine items that should go on the toolbar and where on the toolbar they should go
- Save configurations

Access to configuring a screen display shall be password protected so that only those authorized to access the screen display will be able to do so.

Customizing screen configuration shall not interrupt any radio dispatch functions.

Console Dispatch Program

A console dispatch program shall be provided. The dispatch program shall maintain all dispatch functions and the graphical user interface. The console dispatch program shall provide a Microsoft Windows™ screen display. The screen display must utilize the GUI (Graphical User Interface) technology. Non-Microsoft Windows or non-GUI screen displays shall not be acceptable.

GRAPHICAL USER INTERFACE DISPLAY

Screen Layout

The screen shall follow Windows™ formatting standards and shall include Menu Bar, Tool Bar, Icons, etc. System indications and operator commands shall be in the form of icons which are intuitive to the operators. The screen layout shall consist of the following major areas as a minimum: Title Bar, Clock, Dispatch Work Area, Activity Log, VU meter and status area.

All radio dispatch functions shall be operable from one screen display. Operators shall not be required to access another screen display in order to perform a radio dispatch function.

The screen display shall be graphical and intuitive. Each and all indications shall be graphical and shall display a text definition when selected. Each operator's screen configuration shall be programmable and specific configurations can be tied to a dispatcher log-in account. The Console Dispatch Program shall contain the tools required to configure the GUI.

Each area of the screen shall be capable of being customized with respect to colors (the full windows palette should be supported), size and scaling independently from each other. Scaling shall affect the size of the resources in each area and have a relative range of at least 30-300%.

Title Bar

A Title Bar shall be located horizontally across the top of the screen. The menu shall contain the console label and allow access to a pull-down window revealing menu items for selection. The selected menu item shall be highlighted. Selecting anywhere outside of the menu window shall close the menu window.

Clock

A clock shall be provided on the screen. This clock shall have a time display of Hours:Minutes:Seconds. Either a 12 or 24-hour display shall be available. The display of hours:minutes:seconds shall be synchronized with the internal time generator mechanism determined at system configuration. The console shall support the ability to be synchronized by an external WWVB/GPS signal received by a dedicated WWVB/GPS receiver.

Dispatch Work Area

The dispatch work area shall contain all resources including radio resources, phone lines and input/output controls. All resources shall be displayed in window tiles. All resources shall be organized into folders/screens.

Each folder/screen shall be capable of displaying a combination of radio resource, phone line, input/output control and function tiles. The same tile shall also be capable of being represented in different folders. These resource tiles shall be capable of being moved around on the screen or placed anywhere within a folder. The ability to move, assign and de-assign resources shall be password controlled.

Patch/Multi-Select Area

There shall be the capability of supporting 11 patches and 11 multi-selects on each operator position. No dedicated area shall be assigned to these functions; instead they shall be controlled via individual icons on the display.

Activity Log

The activities of the console system shall be displayed in a log. This activity log shall display the resource alias, unit ID/Alias (if applicable), call type, and start/stop time of inbound calls. The calls shall be displayed in a first in - first out basis. The activity log shall also have the capability of displaying multiple views of the activity within the activity log including filtering by Emergency Calls, Calls on Select resources and Calls on Unselect resources. The activity log shall be capable of being resized and fully hidden.

Page History Window

The history of all pages sent by the dispatcher shall be displayed in a log. This log shall display the type, format, code of the page together with the channel, frequency, status and time that the page was sent. The page history window shall be capable of being resized and fully hidden.

Error Message/Status Area

A one-line area shall be designated to be the error message/status area. This area shall display any user and system errors in abbreviated text format.

Resource Tiles

Radio resource tiles shall be capable of being displayed in a range of different sizes, each one displaying a different amount of information regarding the resource status. The actual information displayed in each size will be dependant upon the resource display configuration.

The radio resource shall be capable of supporting the following command and indication icons:

Radio Command Icons

- Transmit/Instant Transmit
- Coded/Clear
- Repeat
- Frequency Select
- PL Select
- Main/Standby, Main/Alternate
- Takeover
- Volume control
- Mute R 2
- Mode Select (APCO 25 channels)
- Scan Control (APCO 25 channels)

Radio Indication Icons

- Inbound call
- Patch
- Transmit/Busy
- Cross mode Alert
- Select

Manistee County 911 Console and Voter Replacement RFP

The following commands and indication shall be available for telephone resources.

Telephone Command Icons

- On/Off hook
- On hold
- Phone/Radio
- Radio/Phone

Telephone Indication Icons

- Idle
- Ringing
- Off hook at this operator position
- Off hook at another position
- On hold

When a resource is selected, there shall be an intuitive indication that the resource is selected.

Resource Display

Each resource shall be displayed as a resource tile. A resource name of up to 16 characters shall be able to be assigned to each resource through the console system database manager.

Resource Name

Each resource tile shall display the name of the resource it is associated with. Authorized personnel through the set-up function in the console configuration manager may change this name. The operator shall not be required to associate numbers with a resource to perform any function.

Resource Selection

An operator shall be able to select a resource with a single button-press. The operator shall select a resource by choosing the actual resource tile on the screen. Selecting a resource by entering a number shall not be acceptable. The color scheme of selected and unselected resources can be set at configuration. Default color schemes will be included with the application. Selecting the resource will route receive audio to the Select speaker and will route microphone audio and PTT signals to the corresponding base interface module. Selecting any resource tile shall deselect all other resource tiles of the same kind (unless the console is in the Multi-Select mode). One of each, radio and telephone, resource shall be able to be selected simultaneously.

Resource Types

The graphical user interface shall be capable of displaying the following resource types:

Multi-Frequency Transmitters

When multi-frequency transmitters are present in the system, a frequency indicator shall be provided in the appropriate resource control tile. All multiple frequency resource control tiles shall send the frequency information to the base station and to all parallel consoles within one second following the change (unless the station is keyed). The user shall be able to assign names of up to 16 characters to each frequency through the set-up function of the console application.

Multi-Frequency Receivers

All multi-frequency receiver stations shall appear to the operator as being separate, single frequency stations. Lockout features shall prohibit an operator from placing more than one of the control windows related to a multi-receiver station into a patch or multi-select condition.

Telephone Interconnect

A telephone interconnect control tile shall be provided for each telephone interconnect module that shall be made available to the console operator. This shall allow an operator to access a commercial phone line directly from the console without the use of a separate telephone device. It shall also be used to answer or initiate a phone call for phone patch operations. It shall not be required to run separate phone lines from a telephone back to the central electronics package. All the functions which would be done by an external phone shall be self-contained within the console system. Multiple lines shall be handled through multiple phone interconnect control tiles and modules.

All indications and controls shall be represented by graphical icons. When a call is received, a ringing phone icon shall flash and a telephone-like ringing tone will be heard in the console's unselect speaker. The telephone shall be capable of displaying Caller-ID if the telephone company supports this feature. If a headset is used, the phone interconnect shall revert to duplex operation. If any other microphone is used, the phone interconnect shall revert to simplex operation to prevent acoustic feedback.

The operator shall also be able to place a call from the console using the console's DTMF real-time dialing feature. A control shall be provided that permits the operator to force the direction of transmission when a noisy phone line or radio link is encountered.

Receive-only Modules

Module graphics shall be provided for Receive-only channels with no Transmit function. Such modules shall be organized as two (2) receive-only channels per module with a full range volume control for each channel. An integral alternate action, touch MUTE graphic shall be provided with each volume control to allow the module to be run at full volume or a reduced setting without having to readjust the control setting. Associated different colored indications shall continuously show whether the module is in the full or adjustable volume mode. A CALL indicator shall be provided to show audio activity on each channel. Where applicable, each channel shall include a SELECT graphic to permit the receiver to be directed to the Selected Audio speaker or to be placed in a crosspatch with other Transmit/Receive modules.

Comparator Control

Module graphics shall be provided for Comparator Control for channels that utilize voting receivers and audio comparators. The operator shall be able to monitor the comparator's activity and force selection to a different site. The functions provided shall be:

1. DISABLE – Allows the Dispatcher to remove the receiver from the system in the event of interference.
2. RECEIVE – Indicate that the receiver is unsquelched and had audio present
3. FAIL – Indicates a failure of the audio path, receiver, or module
4. VOTE – Indicates that the receiver has the best Signal to Noise Ratio and is audio from this receiver is being passed on the the console and/or repeated.
5. FORCE VOTE - Allows the Dispatcher to manually select a different receiver.

Call Indicator

A Call indicator shall be included for each resource tile. The call indicator shall look different on a Selected resource as compared to one on an Unselected resource. In order to minimize potential distractions to the operator, no text or other call indication shall be displayed in the resource tile or anywhere else on the screen when an inbound call is not present.

Patch Indicator

A Patch indicator shall be included on each resource tile. This Patch indicator shall show when the associated resource is in a patch group at an operator position, what patch group it is in, and when it is not patched. A resource may participate in only one patch at a time. It shall be possible to establish up to 11 simultaneous cross-patch or phone-patch conversations per operator position. A patch shall not inhibit the operator from continuing with normal dispatching functions.

Transmit/Busy Indicator

A Transmit/Busy indicator shall be graphically displayed on each resource tile. This indicator shall show whether the associated resource is in transmit mode from this operator position or if it is in busy mode due to transmission from another operator position. The busy indicator shall be displayed whenever any parallel operator positions are connected to the same base station and transmitting on the same resource.

Auxiliary Inputs and Outputs

Auxiliary inputs/outputs represented by tiles smaller than radio resource tiles. The input/output states shall be represented by graphical icons. Names of up to 12 characters shall be assigned to each tile.

Control Output

Form "C" relays capable of switching 1A at 24V shall be provided to control external devices. The relays shall be accessible by all dispatch position within the system. Support shall be provided for both Momentary and Latching controls.

Control Inputs

Opto-coupled inputs shall be provided to detect external relay closures. The Opto-coupled inputs shall be accessible by all dispatch position within the system. Support shall be provided for both Momentary and Latching inputs. It shall be possible to assign an audible alarm to an such that the alert is heard at the console when the input is activated. The system shall allow up to 32 alarms to be assigned. Individual indicators for each alarm input shall be provided on the screen. A control shall be provided on the screen to silence the alarm at a console.

Local PTT Relay Closure

A form "C" relay capable of switching 3W at 150mA or 60V shall be provided to mute or control a device in or near the console. Relay shall be activated by a PTT (Push to Talk) function at the operator position. Control and parallel status of this device by other console operators shall not be required.

Logging Recorder Output

The console shall support the ability to connect to a dual Instant Recall Recorder such that the recorded audio on each port can be configured. Examples of the audio would be Selected Radio Audio, Unselect audio, Monitor Speaker Audio and External Telephone audio. A port shall be provided to allow playback of the IRR recording through the Select speaker/Headset. The Instant Recall Recorder ports shall be located at the operator position.

Auxiliary Signaling Encoder

An audio input and PTT input shall be provided to allow for the connection of an external paging/signaling encoder. This encoder shall operate only on the selected resources. The encoder's PTT closure shall control the selected resource(s) and the signaling tone(s) shall be transmitted on those resources. Signaling tones on or near the console guardtone frequency shall not be used.

General Console Operator Position Features

Paging

Paging capability shall be provided. The paging function shall be strictly tone and tone-and-voice paging unless part of MDC1200 or APCO 25 signaling. Pages shall be capable of being sent on multiple channels sequentially.

A visible indication shall be given when each individual page ends. The paging tones shall be heard in the speaker for the channels that are sending the pages.

A visible indication of a page that failed shall be given on the screen.

Pre-programmed pages and groups shall be created and modified via the console application program. The information shall be stored in a file that can be transferred between positions.

Quick Page

Quick paging shall be provided. The quick page function shall support individual and group pages. The quick page shall be represented on the screen as a resource tile. An operator shall be able to immediately send a quick page with a single-button press. When the button on the Quick Page resource is pushed, the channel and frequency shall automatically be selected based on specific pre-programmed information. Up to 50 pages shall be supported in a pre-programmed group page.

Standard List Page

Standard list page shall be provided. The standard list page shall reside in separate stand-alone window within the dispatch program. The window shall be opened from the menu bar or from a toolbar button. With the window open, the standard list page shall be brought forward using a folder type tab. The folder shall display a list of pre-programmed pages and groups. A dispatcher shall then be able to choose one or more pre-programmed pages and/or pre-programmed groups to send. After selecting the pages and groups, the dispatcher shall be able to press a send button to send the pages.

Manual Page

Manual page shall be provided. The manual page may reside in a separate stand-alone window within the dispatch program. The window shall be opened from the menu bar or from a toolbar button. Once opened a keypad will be displayed and the user shall be able to select from the available paging formats, channels and frequencies prior to creating the page and sending it.

Paging Formats

The following Paging formats shall be supported as a minimum

- Motorola 1+1
- Motorola 2+2
- Quick Call II
- GE Type 99
- Motorola 5/6 Tone
- NEC 5/6 Tone
- REACH
- Plectron
- DTMF
- Knox Tone

In addition to the above fixed formats the console shall support the ability to create custom single and two-tone paging formats. Parameters that can be customized include tone frequencies,

durations and inter-tone delay.

Sequential Paging

When a series of pages are to be sent, either as custom stack or pre-configured group the console shall support the ability for the radio resources to be held open for a voice message transmission on all the selected resources at the end of the stack or group has been sent. In the event that one of the resources was busy, an indicator will notify the operator and he/she must call that resource again.

PL/DPL Strip

A resource shall have the capability to send a PL/DPL strip command to a base station during paging. If a resource is not so equipped, standard transmit commands will be generated during paging.

Single Alert Tone

An Alert Tone function shall be provided on screen that places a 1000 Hz tone burst onto the selected resource(s) when pressed. The Alert tone can be configured such that the resource will remain keyed for a programmable period of time after the Alert Tone has been sent to allow Voice Annotation to be sent.

Warbling Alert Tone

An Alert Tone function shall be provided on screen that places two tones alternating at a 2 Hz rate onto the selected resource(s) when pressed. The Alert tone can be configured such that the resource will remain keyed for a programmable period of time after the Alert Tone has been sent to allow Voice Annotation to be sent.

Pulsed Alert Tone

An Alert Tone function shall be provided on screen that places a pulsed (2 pps) tone on the selected resource(s) **when** pressed. The Alert tone can be configured such that the resource will remain keyed for a programmable period of time after the Alert Tone has been sent to allow Voice Annotation to be sent.

Volume Control

The volume shall be controlled from a control on the speakers or the individual resources.

Speaker control

The speaker control shall provide continuous volume level control.

Resource control

One volume control shall be provided in each resource tile. The resource control shall provide fifteen discrete levels of volume control. Changing the volume shall be represented with a graphical slider. The volume shall decrease when the control is slid to the left and increase to the right. Text indication shall also be available to indicate a change in volume.

The volume level shall automatically revert to a predefined level as set by the configuration when the corresponding resource tile is selected.

Patch

Each patch function shall permit patch control of two or more radio and/or phone resources by the console operator. Up to 11 Patch groups shall be provided and contained in a sub-window per operator. Ten of these can be stored. Resources shall be added and removed to the patch window using a 'drag and drop' technique. The operator shall not need to enter numbers for each resource added or removed from a patch. An operator shall be able to monitor or transmit to a

patch created at that operator position. The operator shall be able to visually determine whether the patch is active, idle, or empty.

Each operator shall be capable of up to eleven separate and distinct patches simultaneously. By default, each patch shall be enumerated (1 - 11) via the indicator on the selected resource tiles. A patch busy indication in the resource tile shall be provided for a resource assigned to a patch group by another operator.

Multi-Select

Up to eleven Multi-Select interlocking function(s) shall be provided on the screen to permit the console operator to simultaneously select two or more resources for transmission and reception. These functions shall be represented a button on the screen. The names of each multi-select group shall be able to be changed by the operator.

The usual interlock action of the single-select function on the screen shall be defeated when in the Multi-Select mode. A resource may be added to or removed from a Multi-Select with a single button-press, by choosing the actual resource on the screen. The operator shall not need to enter numbers for each resource added to or removed from a Multi-Select group. The resources in a multi-select group shall be held in memory for quick recall by selecting the corresponding multi-select tab at a later time and may be modified by the operator at any time.

If an operator attempts to transmit on a Multi-Select group which includes a resource(s) in use by a different console operator, the resources already in use shall be excluded from the transmission and the remaining resources in the group shall be keyed.

With each multi-select, a Multi-Select APB (All Points Bulletin) or Multi-Select General Transmit control shall be provided on the screen. This control shall provide a transmit function for those resources stored in the memory of the associated multi-select. The operator shall not be required to change the select configuration of the console in order to use this function.

Supervisor

An account can be defined as a supervisor account. This shall effect the dispatcher transmit priority on a radio resource when using the instant transmit button. When an operator is overridden, the Busy indicator will light to indicate this condition.

Mute

A timed unselect All Mute function shall be provided on the screen that mutes all console unselect audio after the function is activated. The audio shall be automatically restored to previous levels after 30 seconds or when the control is deactivated. This automatic timer shall be field adjustable up to 120 seconds through the console configuration manager. The muting level shall also be adjustable between total mute and a drop in level of 24dB via the Console Configuration Manager.

Cross Mute

It shall be possible to cross mute on a resource-by-resource basis console wide, in order to compensate for RF interference of transmitters and receivers (the maximum number shall depend upon system size). It shall also be possible to acoustically cross mute resources on an operator-by-operator basis, in order to eliminate acoustic feedback between co-located operators. Acoustic cross muting on a operator basis shall be automatically disabled on selected resources when a headset is plugged into the headset jack. Both types of cross muting shall be field programmable via the console database management program.

Squelch Disable

A squelch disable control shall be able to be displayed on the screen to disable the coded squelch in base station receivers. The squelch disable control shall be operable through a single button press. This control shall permit the operator to monitor the selected resource(s) before transmitting. The squelch disable control shall operate in parallel with the squelch disable footswitch.

Safety Switch

To prevent accidental activation of an auxiliary input/output control or quick page, a Safety Switch shall be provided on the screen to protect the control/page. To activate auxiliary input/output controls or quick page buttons that are protected by a safety switch, it shall be necessary to first select the safety switch icon and then within 5 seconds select the desired control. One Safety Switch shall be provided for all inputs/outputs which are to be protected.

Takeover

A control/indicator shall be provided on the screen to disconnect parallel connected remote controllers from the base station, thereby providing supervisory control. The control/indicator shall control a suitable switching relay in the remote electronics. Disconnected controllers shall not be able to communicate with the console system or the base station until reconnected by the console operator. The function controls/indicators in all similar consoles shall be updated whenever any console operator makes a change, and any operator shall be able to initiate a change. On 4-wire stations, only the transmit path shall be broken. This control/indicator may be permanently displayed or hidden from view until it is required. The operator shall be able to display or hide this control with minimal button presses.

Repeater Control

A control/indicator shall be provided to disable/enable the base station/repeater in-cabinet repeat capability via remote control. The corresponding controls/indicators in all similar consoles shall be updated whenever any console operator makes a change, and any operator shall be able to initiate a change. This control/indicator may be permanently displayed or hidden from view until it is required. The operator shall be able to display or hide this control with one button press.

Self-Repeat/Through Console Repeat

A control/indicator shall be provided which allows receive audio from a duplex base station or a voting comparator to be re-transmitted under operator control through the console. The same controls/indicators in parallel consoles shall be updated whenever a console operator makes a change. Any operator shall be able to initiate a change. This control/indicator may be permanently displayed or hidden from view until it is required. The operator shall be able to display or hide this control with minimal button presses.

Multiple Tone-Coded Squelch Control

Controls/indicators to control a multiple tone-coded squelch equipped base station with up to 8 tones shall be provided on the screen at each console. The controls/indicators shall control the encoder/decoder in a single base station. The controls/indicators in all parallel consoles shall be updated whenever a console operator makes a change, and any operator shall be able to initiate a change. The eight function tones shall be 1350, 1250, 1150, 1050, 1750, 1650, 1550, and 1450 Hz. Authorized personnel shall be able to determine whether this control/indicator is displayed on the screen when they are customizing screen configurations. This control/indicator may be permanently displayed or hidden from view until it is required. The operator shall be able to display or hide this control with one button press.

Mute R2 Switch

A control/indicator shall be provided to mute/unmute the audio from receiver #2 in a two receiver base station that is connected to the console via a two-wire audio line. The function controls/indicators in all parallel consoles shall be updated whenever any console operator makes a change and any operator shall be able to initiate a change. This control/indicator may be permanently displayed or hidden from view until it is required.

Main/Stand-by Switch - Relay Control

A Main/Stand-by relay control shall be provided to permit the operator to select either the main or the stand-by base station for operation. The control/indicator shall control a suitable switching relay (two- or four-wire) in the remote electronics package. The disconnected base station shall not be operable in any manner until reconnected. The corresponding controls/indicators in all similar consoles shall be updated whenever any console operator makes a change, and any operator shall be able to initiate a change. This control/indicator may be permanently displayed or hidden from view until it is required.

Main/Alternate Switch-Interface Control

A Main/Alternate interface control shall be provided to permit the operator to select one of the two base stations for operation. Each station shall be provided with its own interface in the central electronics package. The switch shall control which base station interface module should be used. The interface module that is not selected shall not be operable, except for continuous diagnostic testing, until it is selected again. The interface controls in all parallel consoles shall be updated whenever a console operator makes a change. Any operator shall be able to initiate a change. In case of a failure in the active base station interface module, the system will automatically switch to the other station and signal the operators of the change. This shall not be compatible with Main/Standby relay control. This control may be permanently displayed or hidden from view until it is required.

Coded/Clear Operation

A control/indicator shall be provided to switch encrypted products between the Clear and Coded modes. When controlling an encrypted channel the console shall automatically send a two-function tone sequence. The first tone in the sequence shall set the scrambling mode in coded or clear. The second tone shall select the station frequency and initiate the transmit function. This control/indicator may be permanently displayed or hidden from view until it is required. The operator shall be able to display or hide this control with one button press.

Alphanumeric Digital Display

Designated channel modules shall include an eight (8) character alphanumeric display area. This display shall be used to show talkgroup names and/or unit IDs and/or emergency messages and/or various system messages. Where applicable, the data displayed shall be actual names not message or ID numbers. As previously specified, the need for a dispatcher to cross reference names to numbers shall not be allowed in this system. The full 128 ASCII character set shall be supported in steady and flashing display modes and multiple colors.

Unit ID/Message Display

The alphanumeric display shall store the ID of the last unit call received. The display shall have the ability to queue up to ten (10) incoming calls and display them in a FIFO format at the will of the dispatcher. The display shall indicate if multiple calls are so queued.

Manistee County 911 Console and Voter Replacement RFP

Emergency Message Display

Emergency messages shall be indicated by a flashing ID, an Emergency ID character and an audible alert. Dispatcher acknowledgment of the message shall silence the audible alert and stop the flashing display. Should multiple emergency messages be queued in the display stack, the Emergency ID character shall continue to flash until all such messages have been viewed by the dispatcher.

Message Recall Review

The dispatcher shall have the ability to recall the last ten (10) incoming messages displayed on any channel and list them in page format for review.

CENTRAL ELECTRONICS PACKAGE

General

The central electronics package shall contain the base station interfaces and receiver interfaces that are required to control the system. It shall also contain the required phone patch interfaces, operator interfaces, signaling interfaces, power supplies, reference clock interface and any auxiliary input and/or output interfaces.

All of the modules in the central electronics package consoles shall be contained in EIA panel-mount chassis (shelves). The central electronics package shall be comprised of one or more shelves. Each shelf shall incorporate plug-in slots for the various module interfaces. Each shelf shall include an integrated back plane with connectors for the interface modules, operator positions and audio. Hand-wiring of the back plane shall not be permitted.

Future expansion shall be accommodated by adding more interfaces into available shelf slots and reprogramming or by adding shelves. Connections to any additional interfaces shall be available through the 50 pin telephone-type connector, without the need for additional back plane wiring.

Modules and Operation

Audio Signal Processing

Each audio signal presented to the central electronics package shall be converted to its digital equivalent using 32K or 64K bit/Second Pulse Code Modulation (or an equivalent digitization process). The digitized representation shall be multiplexed, using Time Division Multiplexing techniques and routed to all other modules in the central electronics package. After routing, the digital signal will then be converted back to an audio signal. Up to 168 audio signals may be so processed. Audio signals will include receive audio from stations, microphone audio from Dispatch positions and receive telephone audio.

Analog switch matrix techniques shall not be acceptable because of their susceptibility to RF interference, cross-talk issues, and noise degradation problems.

Tone Control

The tone remote control system shall be operable over wire lines or over any path used for speech, such as a radio frequency link. Tone control shall follow the following format: High Level Guard Tone – Function Tone – Low Level Guard Tone.

The tone sequences shall be generated by the microprocessor on the involved base station interface module in response to instructions over the data bus. There shall be the ability to define multiple tone sequence plans within the system; each interface will use a single tone sequence plan.

The Tone signaling plans shall allow the following parameters to be set

Frequency

Tx 1 through 16	CTCSS 1 through 8
Repeater Control	Wildcard 1 and 2
Monitor	Encryption Control
PL Strip	Mute R2

Manistee County 911 Console and Voter Replacement RFP

Duration

High Level Guard Tone
Function Tone
Inter-Function Tone delay

Gain

High Level Guard Tone
Function Tone
Low Level Guard Tone

System guard tone frequencies of 2175 Hz, 2325 Hz, 2100 Hz, 2300 Hz shall be available.

All modules shall be capable of generating a second sequential function tone that may be required for special purposes.

In compliance with FCC regulations, if control circuit facilities should be lost, the system shall be designed such that the base station transmitter ceases transmitting within 500 milliseconds.

Tone Control Specifications

The tone control system shall meet or exceed the following specifications:

CONTROL TONE FREQUENCIES 300 to 3300 Hz

TONE DURATION 6000 milliseconds, maximum

FUNCTION CAPABILITY 16 available tone frequencies

CONTROL LINE RESPONSE +1, -3 dB from 300 to 3300 Hz

DC Control

The console shall support DC control operable over a continuous wire line link. The control method can be configured for either Pulsed or Continuous current. There shall be the ability to define multiple DC plans within the system; each interface will use a single tone sequence plan. The DC plans shall allow the following parameters to be set

Current

- Tx 1 through 4
- Repeater Control
- Monitor
- PL Strip
- Mute R2 (Pulsed only)

Duration

- Inter-function Delay (Pulsed only)

DC Control Specification

CONTROL CURRENT -12.5mA to 12.5mA adjustable in 0.5mA steps

DC VOLTAGE 125V

PULSE DURATION 700 ms

MAXIMUM LOOP RESISTANCE 10 KOhms

Console Operator Interface

Each operator position shall communicate to, and be supervised by, its own operator interface module in the central electronics package.

All switching, control and audio processing shall be performed utilizing DSP and microprocessor technology. On the printed circuit board, all active devices shall have designations screened onto the circuit board at the device location. All optional jumper connections and auxiliary circuit output connections should also be screened onto the board for easy reference.

Analog Base Station Interface

Each module shall consist of a printed circuit board that contains a microprocessor, DSP, related circuits, digital automatic level control circuitry, line driver amplifier, both two- and four-wire line termination transformers, and fault detection circuits. Each channel control can be independently set for any of the following:

- Tone Remote Control
- E&M
- DC Control

Both Tone Remote Control and DC Control options can provide a PTT relay output.

All switching, control and audio processing shall be performed utilizing DSP and microprocessor technology. On the printed circuit board, all active devices shall have designations screened onto the circuit board at the device location. All optional jumper connections and auxiliary circuit output connections shall also be screened onto the board for easy reference.

Each channel control interface shall include the capability to detect the keying signal from parallel controllers and to inform the console operators that the channel is busy.

In addition to the PTT relay, each channel interface shall include an input that can be defined for either COR or High Speed Mute functionality.

The receive section of the module shall contain a second line transformer to allow four wire operation. Audio signals in either transformer shall be connected to automatic level control circuitry. No line input level control shall be required; rather, circuitry shall be provided which automatically adjusts the amplifier gain over a 70 dB range of inputs to assure a constant output (less than 3 dB change). The gain shall not increase during a pause in speech, but rather, be held in memory until a new input is received. The output of the automatic level control circuitry shall be digitized and placed into a switch-selectable time slot on one of the digital buses under microprocessor control.

A mixer amplifier shall be provided to combine the audio signals from both line transformers. Continuous control tones shall not be present on this output. The isolation between the two transformer circuits shall be preserved. The mixer's output shall be available for a logging recorder and similar applications. It shall be a nominal 600-ohm balanced output and the output level can be set between –60dBm and +11dBm.

Failure detection circuits shall be included on the module. Power for the module shall be derived from the central power supply through on-board voltage regulators.

Manistee County 911 Console and Voter Replacement RFP

Base Station Interface Specifications

The Station Interface shall meet or exceed the following:

Transmit Line Outputs

LINE OUTPUT -60dBm to +11 dBm into 600 ohm line, adjustable
LINE OUTPUT IMPEDANCE 600 ohm or 10,000 ohm balanced

Receiver Line Inputs

RECEIVE SENSITIVITY -60 DBM TO +11DBM, ADJUSTABLE
CALL LIGHT SENSITIVITY -32 DBM TO -5DBM, ADJUSTABLE
LINE BALANCE 60 DB AT 1004 HZ
LINE INPUT IMPEDANCE 600 ohm or 10,000 ohm balanced

Mobile Radio Interface

The console interface shall support full control of a number of radios to allow access to a variety of Trunking systems. This control shall allow the dispatcher to have complete access to all the radio features through the dispatch console. Radio systems to be supported include:

APCO Project 25 Trunking
PassPort

Telephone Interface

The telephone interface shall incorporate the circuitry required to directly connect a public switched telephone line to the control center. The module shall allow the control center operator to answer or initiate a phone call using only the control center electronics. The phone call may be patched to a radio channel to allow the telephone user to carry on a conversation with a two-way radio user.

This module shall be capable of seizing and releasing a loop-start phone line, creating a ringing indication when ringing voltage is present on the phone line and providing a VOX indication when voice is present on the phone line.

The interface shall support Caller ID if the service is made available from the telephone company.

Solid-state circuitry shall be employed on this module. For easy reference all active devices shall have designations screened onto the circuit board at the device location. All optional jumper connections and auxiliary circuit output connections shall also be screened onto the board for easy reference.

Failure detection circuits shall be included on this module. Power for the module shall be derived from the central power supply through on-board voltage regulators.

MDC1200

Each station interface shall incorporate the ability to provide encode/decode of MDC1200 signaling. This capability shall be a configurable parameter in the station interface via the management tool and shall not require any additional hardware. Wild card function 'F' shall be supported by the system to enable group alerts.

Comparator Interface

Control and status of a receiver voting system shall be available at each console. The console comparator interface shall accept status inputs from a comparator and provide control lines to a comparator. Using the proper console controls, the operator shall be able to monitor the comparator's activity and force selection to a different site. The console controls shall be located on the operator's CRT screen. The functions provided shall be:

1. DISABLE--output function
2. RECEIVE--input function
3. FAIL--input function
4. VOTE--input function
5. FORCE VOTE--output function

End-To-End Specifications

The console system shall meet or exceed the following specifications from a single base station interface to the speaker and from the microphone to a single base station interface. Individual module specifications shall not be allowed in this area.

FREQUENCY RESPONSE	300 to 3,300 Hz, +1, -3 dB referenced to 1,000 Hz at less than 2% distortion
TEMPERATURE RANGE	0°to + 50°C Central Electronics Package 0°to + 35°C Operator Position equipment
HUMIDITY	The Central Electronics Package shall meet the rated performance specifications during sustained operation at +50 Degrees Celsius and 95% humidity, non-Condensing.
HUM AND NOISE (NOTE 1)	65 dB below rated output of all ports
CROSS-TALK(NOTE 1 & NOTE 2)	-65dB at 0dBm output level
LEVEL GAIN CONTROL	Gain will not increase in the presence of noise or the absence of voice. Constant output (less than 3 dB range) for all voice input levels over the rated range: Microphone: -60 to -22 dBm Receive Line: -60 to +11 dBm

NOTES:

- 1) Room temperature operation.
- 2) Cross-talk is characterized by either: A) The level of signal from a channel which is being received on one operator position that is unintentionally imposed on a receive or transmit channel signal on another operator position or; B) The level of signal from an operator position which is being transmitted on one channel that is unintentionally imposed on a receive or transmit channel signal on another operator position.

SECTION 5 AUDIO SIGNAL COMPARATOR SPECIFICATION

GENERAL INFORMATION

The Voter shall accept audio inputs from different sources and analyzes them all to determine which one has the lowest Noise or highest audio Signal-to-Noise Ratio (SNR), then selects that signal to be passed on to another device. The Voter chassis shall contain a minimum of ten individual plug-in Site Voter Modules, which use digital signal processing to determine the quality of the input signals. External Pilot tones or COR signals may be used to qualify the audio inputs. A Control Processor Module controls the Site Voter Modules and provides an interface to a computer terminal or other device for remote control & monitoring. A Console Interface Module provides monitoring of the voted signal as well as an interface to a command console.

TECHNICAL REQUIREMENTS

Card Cage and Backplane

The Voter shall be housed in a 19" wide EIA standard rack-mounted card cage equipped with a backplane board into which the modules plug. The backplane shall interface to the outside world via d-sub and terminal strip connectors, and to the plug-in modules via card edge connectors. No active or passive electrical components shall reside on the backplane board.

Power Supply Module

The power supply shall provide a low-voltage DC bus which is fed to each module. The Voter shall meet all of its specifications over a voltage range of 115VAC or 230VAC, +/- 15% from nominal, 47 to 63 Hz. The unit shall also be able to operate on +11 to +15 VDC @ 5A (nominal). The unit shall automatically switch over to DC operation if AC line voltages drop too low. The Power Supply shall contain a battery charger to charge a backup battery.

Console Interface Module

The Console Interface Module shall provide voted audio monitoring via a front panel speaker. This module will have the capability of detecting the EIA Keying tone sequence (F1 function tone) in the console TX audio input, and also have the capability of adding keying tones to the TX audio output. It shall also have audio signal level LEDs and potentiometers on its front panel that may be used for simple adjustment of the TX audio input from the console.

Control Processor Module

The Control Processor Module shall control the entire Voter via an internal high-speed serial bus. It shall request and receive Signal Quality and Signal Present information from each Site Voter Module and determine which module has the best signal. It shall then instruct this best site to output its audio to the voted audio bus. The Control Processor shall provide an RS-232 serial port and a 10/100Base-T Ethernet network port allowing programming and monitoring and control of Voter functions via an external computer or serially-interfaced console. The front panel of the CPU Module shall contain an RJ-45 Ethernet connector, a Fault LED, and three other LEDs that indicate the chassis' status in an expanded system, labeled: Master, Exp 1 and Exp 2.

Site Voter Module

The Voter chassis shall house the Site Voter Modules. Each of these modules shall interface with a receiver and use Digital Signal Processing (DSP) to measure the SNR of its receive audio. The DSP shall also be capable of performing a Signal Quality measurement based on the quantity of high frequency noise in an incoming signal. The Site Voter Module shall also include adjustable audio delay, and transmit audio output. The module's front panel shall include switches to allow any site to be eliminated from voting or to be "Selected" as a voted site regardless of its signal conditions. The front

panel shall also include LEDs to indicate if the associated site is disabled, voted or selected, and other LEDs that indicate if the site's receiver is unsquelched, when TX audio is being steered through this module to a transmitter at the associated site, and if the module (or site) is experiencing a fault condition.

The Site Voter Module software shall be responsible for all receiver audio signal processing functions in the voter. These include Noise Measurement, Signal-to-Noise measurement, pilot tone detection, pilot tone notching, and audio delay. Signal-to-Noise ratio shall be calculated following the measurement of the amplitude of the input signal in various frequency bands. Pilot tones shall be detected, while notching of pilot tones shall be performed bandstop filters. Audio delay shall be provided by running DSP output samples through a variable size circular buffer before sending them to an output D/A converter.

Hot Insertion of Modules

Except the power supply, all modules shall be capable of removal and insertion, without damage, while the unit's main power is on and the unit is operational. Removal and replacement of Site Voter Modules shall have no effect on the voting process being carried on among the rest of the modules in the unit.

Serial Remote Control

The Voter shall be capable of being controlled and monitored remotely via its RS-232 interface. The serial format shall be 8 data bits, 1 stop bit, and no parity. Available baud rates shall be 300, 1200, 2400, 4800, 9600, 19200, 38400, and 57600.

All commands to the Voter shall be sent using standard ASCII characters. The following commands shall make up the Voter remote control command set:

SEL	Manually force a site to be voted
ENABLE	Enable/disable a site from being voted
TX SEL	Select site or sites for console audio transmission (stays active until disabled)
MOM TX SEL	Select site or sites for console audio transmission (stays active until Holdover Timer expires)
CFG	Report hardware configuration (DIP switch settings)
STAT	Report site status (S/N, speech present, vote)
VER	Report software version number
AS	Enable/disable automatic status reporting

Adding applications specific Commands and Status information to the Voter RS-232 interface protocol shall be easily accomplished.

Network Interface Control and Monitoring

The Voter shall contain a 10/100Base-T Ethernet port for in-system programming and an enhanced, web browser based, user interface for controlling and monitoring the voter system

The voter shall incorporate a web browser interface that can be used to monitor and configure the voter. The interface is accessed by opening the IP address of the voter in a web browser. The initial page that appears is an information screen that displays the control processor configuration and DIP switch settings. The console interface module DIP switch settings are also shown on this page. Links to other pages are located across the top of the page. Built in web pages shall include information, network, SVM status, event log, statistic counts statistics, and time statistics. The pages that allow a user to change configuration parameters are password protected.

The voter control protocol defined in section 2.7 can also be accessed via the network interface using the telnet protocol. To access this interface, the user must telnet to the IP address of the CPM-3 module. Once connected, the interface accepts the same commands and provides the same responses as the RS-232 serial port interface.

System Expansion

Additional voter chassis shall be capable of being connected to the first, each expanding the number of voting sites. This expansion capability shall be implemented by daisy-chaining one voter to the next via rear panel Console Interface and Expansion connectors, up to a maximum of three chassis. Each auxiliary chassis shall contain a CPU Module, Power Supply Module, and Console Interface Module in addition to its Site Voter Modules.

SNR Voting and Noise-Only Voting

Each Site Voter Module shall use a spectral approach to continuously measure the Noise or Signal-to-Noise Ratio (SNR) of the audio signal received from each receiver site. Each Site Voter Module shall measure the value using individual Digital Signal Processors (DSPs). Noise shall be measured in the band above 2200 Hz, using a DSP spectral approach. The measurement of signal shall be done in the band of 300 to 800 Hz by a DSP speech detection and measurement algorithm. The Voter shall measure not only the energy in this range, but also the amount of syllabic activity. The SNR result shall be calculated from the amplitude of signal divided by the amplitude of the noise. The SNR measurement shall operate from -6 dB to +36 dB. FM systems work best if only the noise measurement is used for the selection of the best site, while the SNR measurement improves voting performance in more noisy AM and HF systems.

In order for a new site to be voted, one Site Voter Module must have a better noise level or higher SNR than the presently voted site, and maintain this difference for a selected voting delay time.

Data Detect & Lock / COR Lock

While voting voice signals allows transitions in mid-syllable without significant harm to the intelligibility of the speech, transitions from one receiver site to another in the middle of a data stream will cause bit errors and possible resynchronization problems. Therefore, to vote data, the Site Voter Modules shall make a decision initially on the best signal and then lock onto that receiver path until the current transmission is complete (Selectable COR Lock feature).

Alternatively, to vote without COR Lock on normal voice transmissions and use COR Lock only on data transmissions, the Site Voter Modules can be equipped with software defining the data's characteristics so that COR Lock is invoked as long as the data is detected. This version of Data Detect & Lock shall be a special-order option to the Voter.

Valid RX Site Detection

The voter shall offer four different means of detecting when an associated receiver is unsquelched (active COR). Each individual module can select the COR detection type best suited for its associated receiver.

Unsquelched Receiver

When this COR type is selected, the SVM shall assume that there is a valid signal present at all times. If other sites also show a valid signal (based on the COR type selected for those sites) the voted site shall be chosen based on the best Signal Quality of all eligible sites. If there are any sites using the Unsquelched Receiver COR type, one of them shall be voted (even if there is no audio present), as the voter always assumes a valid signal present.

Squelched Receiver

The Voter shall use a noise level-detecting algorithm to detect an unsquelched receiver when pilot tone and hardwired COR can not be used, but the receivers are not constantly unsquelched. If the receive signal when unsquelched is detectably noisier than the squelched signal, the voter shall use this increase in noise level as an indication that the radio is unsquelched. COR shall be maintained while the increase in signal level is present and for a short hang time afterward. The receive audio signal level threshold shall be set on each Site Voter Module.

When there is not a sufficient increase in noise between the squelched and unsquelched receiver audio to operate as described above (usually due to a noisy line), the Site Voter Module shall instead indicate an unsquelched condition when it detects actual speech in the receiver audio.

Receiver with Hard-wired COR

Most LMR receivers can provide a COR output signal. The SVM modules can use this signal as its COR detection method.

Receiver with Pilot Tone

In many public safety applications for receiver voting, each receiver can produce a pilot tone (line proving tone) in its audio to the voter when it is squelched. When the receiver unsquelches, it removes the pilot tone from its audio. The Site Voter Module can use the lack of pilot tone as an indication of active COR.

The Site Voter Module shall support pilot tone frequencies of 1950 Hz and 2175 Hz. The DSP software shall position permanent notch filters at these frequencies so the pilot tone never reaches an associated transmitter. The notch filter tolerance shall be +/-30 Hz with notch depth better than 40 dB.

Software Updates

Software on the Site Voter Modules and on the Console Interface Modules shall be contained in flash memory and shall be capable of being updated by the CPU module whenever software changes are necessary. The Site Voter Module and the Console Interface Module shall make use of an on-board bootloader to transfer code from the CPU Module FLASH memory to the flash memories on the Site Voter Modules and on the Console Interface Module.

Line Fault Detection

The CPU Module shall provide continuous line fault detection by monitoring receiver sites for proper operation. In applications using pilot tones or hardwired COR, the CPU shall disable a Site Voter Module if active COR is detected but no speech is later detected in the RX audio. The fault delay time between the COR detection and the non-appearance of speech that will cause faulting of a site shall be programmable to OFF, 15, 30, or 60 seconds. As soon as speech is again detected, or inactive COR is

Manistee County 911 Console and Voter Replacement RFP

detected (pilot tone appears on that site's audio or the Hardwired COR input is inactivated), the CPU shall automatically enable that Site Voter Module again.

Voting Transitions

The unit's control software shall permit voting transitions to occur immediately if a new signal appears from a voting receiver when all sites were previously inactive or squelched. The software also shall permit establishing a minimum timeframe in which a second voting transition can occur if one had occurred a short time previously. The voting delay settings shall range from 0 to 5 seconds. The purpose of longer delays is to restrict the number of voting transitions that occur when SNR conditions vary rapidly.

Voting Lock (COR Lock)

In varying SNR environments, preventing transitions in mid-sentence may be desirable. Therefore, the voter shall provide a mode of operation in which the Site Voter Modules shall make a decision initially on the best voice signal and then lock onto that receiver path until the current transmission is complete (until active COR is no longer detected).

TX Steering

The CPU Module shall provide for automatic routing of console transmit audio and keying information to the proper satellite transmitter site. If automatic Transmitter Steering is enabled, this module shall select a transmitter for the dispatcher's reply based on the history of which receivers were voted best during the last voting sequence. Thus, the transmitter shall be selected on the basis of which receivers were voted most during the end of the voting sequence, and not solely on which receiver was voted last (since the last voted receiver could have resulted simply from a slow to recover COR or Pilot Tone function)..

The Transmit Steering algorithm shall initiate a Hold Over Timer (programmable for periods of 3, 10 and 30 seconds, or infinite) immediately following the receiver voting sequence. Any dispatcher responses shall be automatically routed to the selected transmitter until the Hold Over Timer expires. The Hold Over Timer shall be restarted each time the dispatcher transmits. After the Hold Over Timer expires (because of no more dispatcher keying), the transmit steering selection shall revert to a Default Transmit Site (either a single "Home Site" or all sites).

The dispatcher shall be able to override the automatic Transmit Steering function by manually selecting which transmitter site to use for a reply. In the voter, this shall be done by issuing a Transmit Select signal to the proper Site Voter Module.

Receiver/Transmitter Groups

The Voter shall have the capability of grouping multiple voted receivers around separate remote transmitters. Each Site Voter Module shall utilize on-board DIP switches to determine the TX group that the site belongs to. Each site shall have two options: not belonging to any group (if set for group 0) or belonging to a group numbered 1 through 7. When groups are selected, console transmissions shall be routed to all sites in the group containing the Site Voter Module selected by Transmit Steering, (which might not be the last voted site).

An additional switch shall be used to select the primary site for the group. If it's important that console transmissions are routed to only one Site Voter Module in the voted group, or if "Group Lockout with Primary Site Failure" is desired, then a primary site must be selected for each group. When a primary site is selected for a group, and any Site Voter Module in the group is the last voted (or Transmit Steering selected) module, subsequent console transmissions shall be routed only to the primary Site Voter Module, rather than to all Site Voter Modules in the voted group. If more than one site in a group is designated as a primary site, console transmissions shall be routed to each primary site.

TX Audio and Steering

The Console Interface Module shall accept transmit audio from the console, adds keying tones and/or delay (depending on set-up) and shall route it onto the TX audio bus which is available to all of the Site Voter Modules. Automatic TX steering shall be controlled by the CPU Module (DIP switch enabled), which shall enable the TX audio gate on the appropriate Site Voter Module(s), causing that module to send out the audio which is currently on the TX audio bus, along with the appropriate PTT signal. Manual TX steering shall be accomplished by changing the logic levels of the TX Select Inputs on individual Site Voter Modules or via RS-232 remote control.

Line Equalization

Line equalization shall be used to compensate for frequency response differences between different sites. The Voter shall vote based on the SNR of received audio, or, when set to the FM (noise only) mode, based on the quantity of high frequency noise in the audio. The "Signal" part of the SNR equation shall be measured from 300 to 800 Hz where a large percentage of speech is present. Noise shall be measured above 2200 Hz, where little speech energy is present. Pilot tone operation shall be offered between 1900 and 2200 Hz. The frequencies between 800 and 1900 Hz, which contain varying amounts of both speech and noise energy, shall be excluded from the SNR calculation.

Telephone lines, particularly long ones, can act as Low Pass Filters, rolling off the frequency response in such a way that the Noise Measurement is reduced relative to the Signal Measurement. Equalization may be helpful for a site that uses a much longer line than the others, or in particular, when a combination of phone-line and microwave-linked sites are used. Microwave links have a relatively wide frequency response and little LPF effect, so almost all noise reaches the Site Voter Module to become part of the SNR measurement. When a transmitter is picked up by a group of receivers that send the audio back to the Voter by a mixture of these two methods- (both microwave and actual wires), there is a bias created in favor of voting the phone line sites due to the lower amount of noise that reaches the Voter from these receivers. The phone line site may have noticeably inferior audio quality but is still consistently voted due to its better measured SNR (caused by the frequency response differences).

Methods to correct this include equalizing the phone line sites or modifying the receivers' frequency responses to compensate for the high frequency loss in the lines. Another is to make use of the Voter's software to modify the SNR measurement to account for the different frequency responses. The Site Voter Module shall be capable of adding a multiplier to the noise portion of the SNR measurement. Three multiplier steps shall be available. Using the line equalization on a Site Voter Module shall bias the voting calculation against that Site Voter Module. It essentially must restore the noise that was lost because of the roll-off in the frequency response. A higher setting shall pull in a higher noise multiplier. (This shall affect the noise calculation only; and shall have no effect on actual audio quality.)

Equalization is likely to be required for installations that mix phone line and microwave links. It may also be useful to try the lower levels of equalization for phone line only installations where a site with poorer audio quality is being voted over a better-sounding site that is also unsquelched. In this case, the frequency response of either the phone line or one of the receivers may be the cause.

Tone Keying Generation

The voter shall accept transmit audio from the console, along with keyline status. Using an on-board DSP, it shall have the capability to mix tone signaling with the TX audio it sends to the selected satellite transmitters. This "Tone Remote" keying shall follow the Motorola/GE (EIA) protocol for North American applications.

TX hang time settings shall apply to tone keying operation only for retransmission of voted audio when the voter is in the Repeat Mode (voted site talkthrough). When single-tone tone keying is selected, the keying tone shall remain present for the set hangtime after the console PTT input is no longer active.

When the EIA tone sequence is used, the low guard tone (also called the hold tone) shall remain present for the set hangtime following the de-activation of PTT.

Repeat Mode (Voted Site Talkthrough)

The Repeat Mode is used to re-transmit voted audio. When the Voter is in Repeat Mode and also in Duplex Mode, the voter shall re-transmit voted audio through all the Default TX site (either a single “Home Site, or all sites, selectable) which can include the voted site. If the Site Voter Module is part of a group, the transmit audio output shall go only to those Site Voter Modules in the currently voted group. If RX groups are enabled, but the voted Site Voter Module is not part of an RX group, the transmit audio shall go to the Default TX site. When in Repeat Mode and in Simplex Mode, voter operation shall change slightly: the voted audio and keying commands shall now not be sent to the voted site. This exclusion can be overridden on a site-by-site basis by a dipswitch on each Site Voter Module..

Note: Console transmissions shall have precedence over voted audio retransmission in most configurations. This means that any time the console PTT input is enabled at the same time that voted audio is present, console audio shall be transmitted instead of voted audio. One exception is when Simplex Mode operation and Simplex Mode Console TX inhibit are both selected. If both are selected, the console PTT input shall be inactive as long as any site is voted

Group Lockout With Primary Site Failure

When RX group operation is enabled, the Group Lockout with Primary Site Failure feature may also be enabled. The purpose is to prevent voting any sites in a group with a faulty transmitter. This ensures that console transmissions will not be steered to a bad transmitter at the group primary site. Since there’s no way for the Voter to know when a transmitter has failed, it shall assume that if the receiver at the transmitter site has failed, the transmitter is also failed. Any time this feature is selected, a line fault at a group primary site shall cause the entire group to be removed from consideration for voting until the fault is cleared.

Hold Over Timer

When Transmit Steering and/or group operation are enabled, a Hold Over Timer (programmable) shall be initiated immediately following the receiver voting sequence. Available selections range from 3 seconds to infinity. All dispatcher (console operator) responses shall be routed to the selected transmitter (or receiver group) until the Hold Over Timer expires. The Hold Over Timer shall be restarted at the end of each dispatcher transmission. This means that the timer shall expire only if the console remains continuously unkeyed for the set timer duration.

After the Hold Over Timer expires (because of no more dispatcher keying), the voter shall return to the Default TX Site and any subsequent transmissions by the dispatcher shall be routed to the transmitter(s) associated with the Default TX Site. This Default Site can be set as either:

1. All sites (multicast)
2. The “Home Site”, a single site that is intended to be connected to a general coverage transmitter that can reach all sites. The Home Site shall always be the lowest-numbered valid site. (“Valid” means present and not TX faulted; this will usually be the #1 Site Voter Module.)

One of the Hold Over Timer options shall be “infinite”, which basically disables the timer, so that all console transmissions are sent to the last voted site until a new site is voted or the console operator manually selects a new site. The Hold-Over Timer feature will not function well if any modules use the “Unsquelled Receiver” COR type as there will always be a voted site when this COR type is present.

Duplex and Simplex Modes

In Duplex mode, the voter shall continue to vote receive sites while the console PTT is active. If console audio is automatically steered by the voter, (if RX groups or Transmit Steering are enabled), the console's audio shall never be steered to a newly-voted site until the console unkeys and begins a new transmission. When set to Simplex, voting shall be inhibited and voted audio shall be muted whenever console PTT is active. Since simplex systems transmit and receive on the same frequency, this voting inhibit during console transmissions ensures that receivers do not vote the console audio.

The Voter shall also hold off voting for an adjustable time period following the completion of a console transmission. This ensures that the voter does not vote the squelch tail that follows that transmission. If a console operator is letting the Transmit Steering algorithm select a site for transmission, and sends several replies to the selected site, this voting hold off shall ensure that the Voter does not vote the squelch tail of one of these replies, which would cause the next reply to be sent to the wrong site.

SECTION 6 UNINTERRUPTABLE POWER SUPPLIES

Each operator position and the central electronics package shall have an UNINTERRUPTABLE Power System (UPS). The UPS shall be a single phase, continuous duty, line interactive, single conversion UPS designed to supply clean regulated power. The design shall incorporate an efficient ferroresonant transformer, micro-processor controller, solid state pulse width modulated inverter and long lasting battery pack that provides immunity to all power line disturbances and power interruptions with no break in AC power. The ups shall have an efficient, flexible method of distributing power.

Industry Standards

The following standards shall apply:

- UL listed 1778 Standards for UPS
- CSA Certified
- FCC Part 15 Section J, Class A

Input Specifications

- Input Voltage: 120/240 VAC, 60 Hz
- Operating Range: +10% to -15%
- Rating: ***Determined by site requirements***
- Frequency Range: 57.5 Hz to 62.5 Hz
- Power Factor: Self correcting to >0.95
- Input Harmonics: <3% THD
- Spike Attenuation: 3000:1

Output Specifications

- Output Voltage 120 VAC, 60 Hz
- Crest Factor: 2.5:1
- Power Factor: 0.7 switch mode rated
- Harmonic Attenuation: 400% at input (Load generated)
- Line and load Regulation: $\pm 3\%$

Battery

- Run Time: 10 min. full load / 27 min. half load
- Type: Sealed maintenance free, gas recombinant, self venting, suspended electrolyte with no gel contaminant.
- Charger: 5 Amp, two stage, less than 25% of amp hour rating.
- Recharge time: 3 hours to full charge.
- Life: Protected Life of 10 years service.

Performance

- Overload Capability: 125% for ten minutes
- Surge Capability: 150% rated output without static bypass
- Frequency Stability: $\pm 0.2\%$
- Common Mode Noise Attenuation: ≥ 120 dB
- Transverse Mode Noise Attenuation: ≥ 70 dB

SECTION 7 GROUNDING GENERAL PRACTICES

Conductor Bending

Sharp bending in conductors are to be avoided. A minimum bending radius of 8 inches shall be maintained. The conductor shall be run as short, straight and smoothly as possible with the fewest number of bends and curves. All bends, curves and connections shall be toward the ground location, rod or ground bar of the conductor.

Dissimilar Metals

The bonding of two dissimilar metals may result in Galvanic corrosion, a reaction that occurs at the junction of dissimilar metals when they are exposed to moisture. The degree and rate of corrosion depends on the relative position of the metals in the electrochemical series.

Some methods for preventing galvanic corrosion are listed below.

- Use the same metal throughout the system when possible.
- Exothermically weld connections of different metals when weld material is available for the metals being bonded.
- Copper conductors shall not be installed on aluminum roofing or siding.
- Aluminum and copper shall not be directly connected to each other unless using exothermic welding materials specifically intended for these two metals to make the connection. Aluminum and copper may be joined with the use of a listed bimetallic transition connector of stainless steel. These connectors shall be listed for the size and number of conductors and marked with AUCU. These connections shall be liberally coated with a conductive antioxidant at the point of insertion into the connector.
- Copper shall not come in contact with galvanized steel.
- Tinned copper shall be used when connecting to a galvanized steel structure.

Securing Grounding Conductors

- External grounding conductors, especially copper straps, are exposed to movement by wind and other physical forces that can lead to damage or breakage over time. The following requirements shall apply when installing grounding conductors:
- The grounding conductor or its enclosure shall be securely fastened to the surface on which it is carried.
- Grounding conductors shall be attached using nails, screws, bolts, or adhesives as necessary.
- The fasteners shall not be subject to breakage and shall be of the same material as the conductor or of a material equally resistant to corrosion as that of the conductor.
- Approved bonding techniques shall be observed for the connection of dissimilar metals.
- Grounding conductors shall be securely fastened at intervals not exceeding 3 ft. (See *NFPA 70, Articles 250-64(b), 810-21 (c), and NFPA 780, Section 3-10.*)